

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2022-104

Anonymous Referee #1

Referee comment on "Basin-scale gyres and mesoscale eddies in large lakes: a novel procedure for their detection and characterization, assessed in Lake Geneva" by Seyed Mahmood Hamze-Ziabari et al., Geosci. Model Dev. Discuss.,
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This paper provides essential information to the researchers in the same study field, particularly scientists interested in mass transport and water quality in an enclosed basin. The authors conducted significant field observations with respect and completed further analysis by using numerical simulations. However, there are some incoherences in the manuscript. For example, the authors mention the importance of the Coriolis effect on a gyre, but there is no detailed explanation and discussion. Also, the authors need to add more literature on a gyre in an enclosed basin. Please see more details below. As mentioned above, this study could provide significant contributions after revising the manuscript. Therefore, I recommend a substantial revision of the manuscript.

- 1) Is only one meteorological station available despite the huge lake size?
- 2) Why is there only one transect in the eastern area?
- 3) In the Materials and Methods, the authors need to mention more details about the field observations, such as the observation period.
- 4) In lines 291 to 293, the authors mentioned, "the three-gyre pattern in the first mode is predominantly controlled by the spatial and temporal variations of wind stress". However, there is only one meteorological station. How did the authors investigate the spatial effect of wind on a gyre?
- 5) Spatially variable winds are one of the major driving forces in many lakes and bays, such as Lake Michigan [Schwab and Beletsky, JGR, 2003], Lake Kinneret [Laval et al., L&O, 2003], Lake Tahoe [Rueda et al., JGR, 2005], Lake Biwa [Shimizu et al., L&O, 2007], and Tokyo Bay [Nakayama et al., JGR, 2014]. Could you provide any information on the spatial variation of the wind in Lake Geneva? Also, please add more discussion about the effect of wind stress curl on the occurrence of surface-layer circulation.
- 6) The authors mention, "Coriolis force plays an important role in the formation of gyres since the width of the lake is much larger than the internal Rossby radius of deformation". I agree with it. Indeed, the authors included the Coriolis effect in numerical simulations. However, there is no investigation and discussion about the Coriolis effect on a gyre. For example, in the northern hemisphere, the vertical velocity at the gyre centre is positive when the wind curl is positive. However, there is a criterion that the vertical velocity changes from negative to positive, depending on whether the Ekman pumping is

dominant. Could you add more explanation about the Coriolis effect on a gyre in the Results and Discussion?

7) In Figures 7 and 8, the arrows need to be improved as it is difficult to understand what they show.

8) In lines 513 to 516, the authors mention the importance of upwelling and downwelling on large lake ecological systems. Only the authors describe the upwelling phenomenon in line 415 in the Results (Figure 10). There is no detailed explanation for it.

9) The paper includes vital information and outcomes. However, it is not easy to follow how the authors obtain the consequences. Could you restructure the study contents to let readers efficiently understand the significance of the study?